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(54) SCREWTHREADED ASSEMBLY FOR TUBULAR ELEMENTS MADE OF A COMPOSITE MATERIAL

(71) We, SOCIÉTÉ D'EXPLOITATION DES PROCÉDÉS PLASTREX-MANHURHIN, S.E.P.M.A., a French Body Corporate of 14, rue de Soultz — B.P. 2159, 68060 Mulhouse-Cedex France do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to tubular components, of synthetic polymeric material which are formed so that they can be coupled together.

The invention is in particular concerned with tubular coupling components made of fibre-reinforced synthetic thermosetting resins. Tubular components can be made from such composite material by filamental winding, centrafuging and various other techniques. Tubes and accessories made of such composite materials are being increasingly used, more particularly for conveying aggressive media, where the chemical resistance and mechanical strength of such materials and their lightness in weight make them preferable to metal.

The main problem limiting the use of such composite materials, more particularly for conveying fluids under high pressures, is the difficulty of making sealing-tight joints, more particularly screwed joints or connections.

When using components of plastics or synthetic resins it is difficult to make fluid tight screwed joints. unions or the like by ordinary mechanical inter-engagement because of the relatively low elasticity modulus of the material and the necessity for very accurate machining of the components to be screwed together and very high standards of surface texture.

In practice, rigid and flexible tubes may be subjected to very severe stresses, such as impact, abrasion and so on, which damage the screw threads and prevent satisfactory mechanical sealing. It is therefore usually preferred to rely upon a sealing gasket for effecting a fluid-type joint, the screwthread connection being responsible solely for the mechanical coupling. In that case the leakage is prevented even if the screwthreads are damaged. However, it is not always easy to select the appropriate shape, quality and positioning of the gasket. Most couplings of this kind which are used for the coupling of two tubes comprise male and female tubular components, the male component being machined and having a collar or local enlargement against which a displaceable screwthreaded ring abuts. The sealing ring or gasket is located in abutting relationship with the female component and is compressed as the screw connection is tightened.

In addition to manufacturing difficulties encountered in making a coupling of this kind, there is the disadvantage that all axial forces are concentrated on the surface via which the sealing ring bears on the collar, with resulting very severe contact stresses which give rise to damage to one and/or the other of the two engaging surfaces. Also, in such known couplings the joint is quite long, the thickness of the ring being added to that of the collar and there is a consequential substantial detraction from the effective length of the coupled tubes.

The present invention provides a screwthreaded coupling of a design which has been found to permit very effective joints to be formed, particularly when the components are made from fibre-reinforced thermosetting resin. The components when coupled define a passageway which is substantially continuous and without abrupt changes in diameter at the transition from one component to the other, and that is also of importance for the purpose in view.

According to the present invention there

is provided a pair of tubular components made from synthetic polymeric material, wherein one component is a female component having a bore which over at least part of its length increases in diameter towards one end of the component to provide a flared socket which is internally screw-threaded in a wider end portion and unthreaded in a narrower end portion thereof; wherein the other component is a male component which has an externally tapered and screw-threaded portion for screwing into said socket and an externally unthreaded portion which is surrounded by the unthreaded narrower end portion of said socket when the components are coupled; wherein each of the said unthreaded portions terminates in a conical face having an angle of convergence larger than the angle of taper of the threaded portion of the socket and of the co-operating threaded portion of the male member, which conical faces are of substantially the same minimum diameter and are in contact or close proximity when the components are coupled; and wherein the said unthreaded portion of the male or female component is formed with a groove for locating a sealing ring for forming a seal between said unthreaded portions.

The angle of taper of a threaded portion is taken as the average or mean angle of taper of such portion.

The change in the angle of convergence of the non-screw-threaded portions of the components reduces the overall length of the coupling while being conducive to giving the male component favourable strength at its terminal end.

In a preferred embodiment of the invention, the male component has at the wider end of its said threaded portion an external flange or local enlargement one face of which lies in close or contacting facing relationship to the end face or rim of said socket when the components are coupled. Preferably the radial extent of the said external flange or enlargement is substantially the same as the thickness of the wall of the socket at its entry end so that the corner edge of the socket wall is protected from damage and such edge is prevented from causing injuries or accidents when the coupled components are handled. The flange or enlargement may have peripheral grooves, notches or the like to facilitate assembly and disassembly by means of a pin wrench.

The socket or female component or the male component or each of them may be fitted to a plain cone machined on a tubular element, or else the socket or the male component or each of them can be an integral end portion of a length of tube or conduit.

Certain embodiments of the invention selected by way of example, will be described with reference to the accompanying drawings wherein:

Fig. 1 is a sectional view of one form of coupling according to the invention, and

Fig. 2 is a sectional view of another form of coupling according to the invention.

Referring to Fig. 1, two tubular elements T, T' are coupled together by a coupling according to the invention comprising a female or socket component 1 and male tubular component 2. The female component 1 is an integral part of the element T' but the male component is secured, e.g. adhesively secured, to a frusto-conical end 12 of the element T. The component 1, has internal conical screw-threading 3 merging at the relatively narrow end of the socket into two non-screw-threaded (plain) conical faces 5', 6'. Face 5' has an angle of convergence or taper substantially the same as the average angle of the screw-threaded face; face 6' has a larger angle of convergence or taper.

The component 2 comprises an external conical screwthreading 4 which co-operates with the interior screw-threading 3 of the female component 1 to provide a mechanical connection between the two elements T and T'. The entry end of the female component is protected, when the components are coupled, by an enlargement 9 of the component 2. The outside diameter of this enlargement is similar to the outside diameter of the socket so that the enlargement protects the sharp edge 11 of the socket wall. The enlargement 9 is formed with recesses, notches or the like 10 which enable the device to be tightened readily by means of a pin wrench.

At the narrower end of the male component 2 it has two non-screw-threaded (plain) external faces 5, 6 which are adapted to contact or lie in close proximity to the corresponding faces 5', 6' of the female 1. The conical face 5 conforms to a cone angle similar to the average angle of the conical screw-threaded face, whereas conical face 6 conforms to a larger cone angle. By virtue of this more abrupt taper, the end of the component 2 is strengthened and the length of the coupling is reduced.

The conical face 5 is formed with a peripheral groove 7 adapted to receive a sealing ring or gasket 8 which is preferably T-shaped in cross section as shown in Fig. 1. In other words the sealing ring shown has an outer portion which is wider than the groove 7 and seats on face 5 at zones abreast of the groove.

The male component 2 can readily be introduced into the socket without any rubbing of or damage to the gasket; also the

gasket is compressed on all surfaces and, after tightening, the remaining clearance between the male and female components is very reduced so that the coupled components define a virtually continuous bore of substantially constant diameter across the joint line between faces 6, 6′ and coupling pressure losses are reduced.

The coupling is sealing-tight at zero pressure and under increasing pressure the sealing tightness remains until the tube itself ruptures. These two advantages make it possible to obviate "priming" of the gasket and more particularly to test an installation under satisfactory conditions. It has been usual for the strength of the coupling to be less than the strength of the coupled tubes so that the testing pressure has been limited. The coupling according to the invention is a considerable technical advance since it increases operating safety and greatly reduces the risk of accidents.

Tubes coupled as described above cannot get out of alignment and can therefore be laid and handled in such a way as to make good use of their flexibility with no impairment of sealing tightness. By the nature of its construction the described coupling can also withstand a higher external pressure than the coupled tubes.

This coupling is of use for tubes of any diameter which are laid horizontally or suspended vertically, and for connections (e.g. elbows and tees). The illustrated coupling components are made of plastics material reinforced with fibres or fabric, e.g. a glass fibre reinforced thermosetting resin. The nature and quality of materials used for the tube and for the ferrule and the gasket depends upon the chemical nature of the fluid to be conveyed.

Either, or each of the components according to the invention can either be integral with the corresponding tubular, element or it can be stuck or otherwise secured to a conical machined end of such element. In the coupling shown in Fig. 2 the female component 1 is stuck to a conical face 13 of a tube element T′ and the male component 2 is secured to a tube element T as in the coupling according to Fig. 1.

WHAT WE CLAIM IS:—

1. A pair of tubular components made from synthetic polymeric material, wherein one component is a female component having a bore which over at least part of its length increases in diameter towards one end of the component to provide a flared socket which is internally screw-threaded in a wider end portion and unthreaded in a narrower end portion thereof; wherein the other component is a male component which has an externally tapered and screw-threaded portion for screwing into said socket and an externally unthreaded portion which is surrounded by the unthreaded narrower end portion of said socket when the components are coupled; wherein each of the said unthreaded portions terminates in a conical face having an angle of convergence larger than the angle of taper of the threaded portion of the socket and of the co-operating threaded portion of the male member, which conical faces are of substantially the same minimum diameter and are in contact or close proximity when the components are coupled; and wherein the said unthreaded portion of the male or female component is formed with a groove for locating a sealing ring for forming a seal between said unthreaded portions.

2. A pair of components according to claim 1, wherein said components are made from fibre-reinforced thermosetting synthetic resin.

3. A pair of components according to claim 1 or 2, wherein the male component has at the wider end of its said threaded portion an external flange or local enlargement one face of which lies in close or contacting facing relationship to the end face or rim of said socket when the components are coupled.

4. A pair of components according to claim 3, wherein said flange or local enlargement is formed with external notches, grooves or the like which facilitate engagement of said flange or enlargement by means of a pin wrench.

5. A pair of components according to any preceding claim wherein a sealing ring having a T-shaped cross-section is located in said groove.

6. A pair of components according to any preceding claim wherein one or each of the components is an integral end portion of a length of tube.

7. A pair of components according to any of claims 1 to 5, wherein one or each of the components is secured to an end portion of a length of tube, e.g. is secured onto a conical face of a length of tube.

8. A pair of components substantially as herein described with reference to the accompanying drawings.

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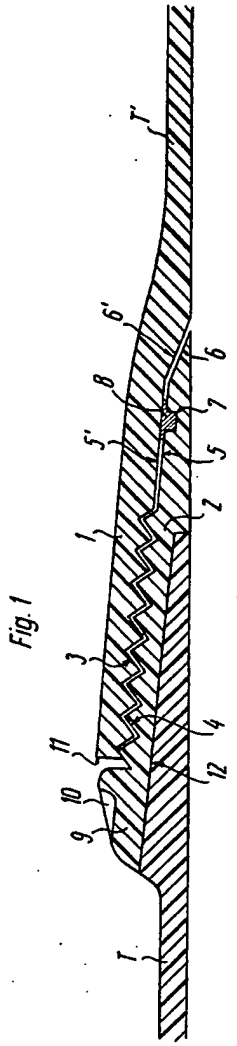

Fig. 1

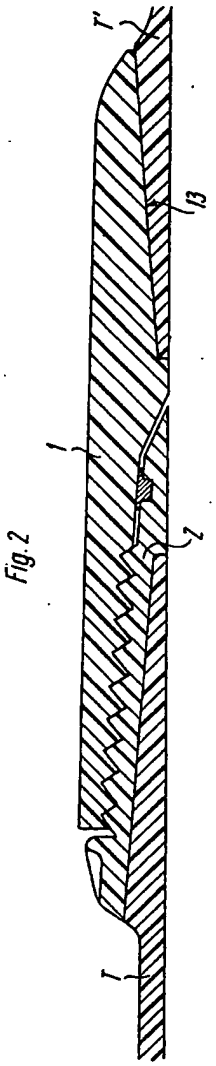

Fig. 2